Clinical Prediction Models: A Practical Approach to Development, Validation, and Updating

Ewout W. Steyerberg
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Readership: This book is suitable for those with a basic knowledge of biostatistics and statistical modeling. The intended audience includes epidemiologists and applied biostatisticians looking for a practical guide to developing and testing clinical prediction models, or health care professionals and health policy makers interested in critically appraising a clinical prediction model.

Clinical Prediction Models is an excellent practical guide for developing, assessing and updating clinical models both for disease prognosis and diagnosis. The book's clinical focus in this era of evidence-based medicine is refreshing and serves as a much-needed addition to statistical modelling of clinical data. The book assumes a basic familiarity with modelling using generalized linear models, focussing instead on the real challenges facing applied biostatisticians and epidemiologists wanting to create useful models: dealing with a plethora of model choices, small sample sizes, many candidate predictors and missing data. This is an example-based book illuminating the vagaries of clinical data and offering sound practical advice on data exploration, model selection and data presentation. Model selection is at the core of the text with in-depth discussion of choices of candidate predictors, pre-specified models, models with interactions, stepwise selection methods in linear models, as well as modelling using generalized additive models (GAM), fractional polynomials and restricted cubic splines. There are also a few pages devoted to more modern selection methods such as Bayesian model averaging (BMA). There is an excellent discussion of estimation bias, over-fitting and optimism in prediction models motivating the use of methods to correct for overestimation of model coefficients. Uniform shrinkage methods, penalized maximum likelihood methods, and least absolute shrinkage and selection operator (LASSO) shrinkage for selection are discussed in some detail.

The author considers many interesting examples of clinical data throughout the text, using data from rich data sources like the GUSTO-1 and the SMART studies. These data sets are made

available on the book's website (http://www.clinicalpredictionmodels.org) for the purposes of promoting practical experience with modelling.

The author uses simple simulations using a few reproducible R commands to motivate the use of imputation methods and shrinkage. These simple but illuminating illustrations are one of the highlights of the book and serve as excellent pedagogical tools for motivating good statistical thinking.

There is some mention of statistical software available to try out the newer estimation methods. The author shows partiality to R software and provides some R code in the book and makes full programs available of the website. This may be an impediment to some readers wedded to menu-driven packages.

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